REMARKS

As an initial matter, Applicants wish to thank the Examiner for the courtesy of the telephonic interview conducted on December 6, 2006. A summary of the telephonic interview pursuant to 37 CFR §1.560(b) and MPEP §2281 is provided as Appendix A to this response.

Claims 1 to 45 are currently pending in this application. Claims 1 to 45 have been rejected. Applicants have amended claims 1, 16, 20, 29 and 40. No new matter has been added; full support for the amendments being found in the specification and drawings as filed. In view of the above amendments and the following remarks, Applicants submit that this application is in condition for allowance. Accordingly, reconsideration and a timely indication of allowance are respectfully requested.

Claim Amendments

Applicants have amended claims 1, 16, 20, 29 and 40 to recite "wherein the charge schedule defines times and time intervals during which the battery is available for charging." This limitation finds full support in the specification and drawings as filed, for example in paragraphs 38, 46 and 49 of the specification. No new matter has been added. Entry of these amendments is respectfully requested.

The Present Invention

The present application is directed to a system and method for modelling or simulating the effect of charging and discharging on a selected battery when it is used in a particular application environment and recharged in accordance with a selected charge return model. The energy needs of the application environment are defined by gathering real-world sensor data from a battery in use in the application environment over an actual cycle of use. This data is then used to determine the energy needs of the application environment and, thus, the energy discharge demands upon a battery in the modelling or simulating operation.

To perform modelling or simulating, a particular battery may be selected; the

characteristics of the selected battery may be defined by its charge parameters. A charge return model is also selected to define the type and characteristics of the recharging operation. All of these factors are evaluated over a predefined charge schedule, wherein the charge schedule defines the times during which the battery is available for recharging. The result of the modelling or simulation operation is production of an energy transfer profile. The energy transfer profile shows the impact on the selected battery of the discharging and charging that occurs over the course of the charging schedule in the application environment. As seen from Figs. 7 to 10, the energy transfer profile allows a user to evaluate whether a particular battery or a particular charge return model is appropriate for a given application environment.

In an embodiment, the present invention attempts to simulate or model the effect of charging and discharging on a selected battery over the course of a day, week, or other time period. The charge schedule defines those times during which the battery is in use and, thus, being discharged, and those times during which the battery is available for recharging. As described in the specification, in some applications the battery in question is in use in an industrial vehicle employed during schedule shift work. Accordingly, the battery is available for recharging during specified times, such as lunch breaks, shift changes, or overnight. A charging schedule defines the times during which the battery is available for recharging and, by implication, the times during which it is in use and thus unavailable for recharging.

Rejections Under 35 U.S.C. § 103(a)

The Examiner rejected claims 1-5, 12-15, 29-33 and 36-39 under 35 U.S.C. § 103(a) as being unpatentable over Joko et al. (U.S. Patent No. 5,939,861) in view of Adams (U.S. patent No. 4,435,675). The Examiner's rejection has been carefully considered but is traversed for the reasons that follow.

Independent claims 1 and 29, as amended, require determining an energy transfer profile for an energy consumer based upon charge parameters, the charge parameters including a charge schedule, "wherein said charge schedule defines times and time intervals during which the

battery is available for charging." Applicants respectfully submit that the amendments to claims 1 and 29 render these claims patentable over Joko et al. because neither Joko et al. or Adams teach or suggest consideration of a charge schedule defining times and time intervals during which the battery is available for charging as claimed.

In contrast to the present invention, Joko et al. are unrelated to modeling or simulating. The Joko et al. reference is directed to monitoring the state of a battery and thereby controlling the charging and discharging of the battery in an electric vehicle or hybrid vehicle. Joko et al. are concerned with adaptively controlling the charging and discharging of a battery based on an ongoing assessment of the battery's state. Joko et al. do not attempt to model or simulate the performance of a battery over the course of a charge schedule in view of the demands of an application environment.

The Examiner admits that Joko et al. do not expressly disclose wherein the charge parameters include a charge schedule and cites to Adams, col. 2, lines 49 to 66 to remedy this defect. However, Adams refers to a "schedule" for performing a charge cycle on a battery. Example charging schedules are depicted in Figures 2a and 3b. The various charging schedules that may be pre-programmed into the memory of Adams' system are used to govern the charging cycle. The charge schedule of Adams does not define times during which the battery is available for charging. Rather, the charge schedule described by Adams provides guidance on the charging current to be used over the course of a charge cycle in view of the starting state of charge of the battery. This is an entirely different use of the term "charge schedule" than is contemplated by the present invention. Moreover, the claims as amended require that the charge schedule defines times during which the battery is available for charging. Adams provides no teaching in this regard.

As compared to the subject invention, neither Joko et al. nor Adams, alone or in combination teaches or suggests receiving a charge schedule, "wherein said charge schedule defines times and time intervals during which the battery is available for charging" or applying a charge return model "wherein the charge return model is constrained by the charge schedule" as

recited in independent claims 1 and 29.

Additionally, Applicants respectfully submit that one skilled in the art would have no motivation to combine the teachings of Joko et al. with Adams. The Examiner states that it would have been obvious to a person having ordinary skill in the art at the time of this invention to combine Adams's battery charging system with a charge schedule and Joko et al.'s battery control system to maximize the charge provided to the battery for a given period of time. Applicants respectfully submit that the charge schedule of Adams cannot be combined with the hybrid vehicle system of Joko et al, because regenerative braking, which is the charge mechanism of Joko et al. is unscheduled and highly variable in duration. Thus, there is a lack of suggestion to combine the references.

In responding to Applicants' argument that one skilled in the art would have no motivation to combine Adams with Joko et al., the Examiner states that Joko et al. track a time interval to know if the charge supplied by regenerative braking over a period of time will possibly overcharge the battery, as taught in col. 6, lines 1 to 5. The cited section of Joko et al. teaches that in the course of controlling charging and discharging, the time integral I of the charging and discharging current is calculated and is used to assess the state of charge of the battery at that instant time. Based on the state of the charge of the battery, the Joko et al. system controls the extent to which regenerated energy is used to recharge the battery or is used to supply the motor-generator.

Applicants respectfully submit that tracking a time interval would not provide any motivation to combine Adams with Joko et al. The concept of a "schedule" or the concept of modeling the battery state of charge over a "schedule" does not make sense in the context of Joko et al., and one of ordinary skill in the art would be hard pressed to modify the Joko et al. system to introduce anything resembling a "charge schedule" as defined in the present application.

The Joko et al. reference relates to dynamically controlling the charging and discharging of a battery based on an ongoing monitoring of the state of charge of the battery. Nothing in

Joko et al. suggest a reflective analysis or modeling of the charging and discharging that may occur given a selected set of charge parameters, energy needs, and a charge return model over the course of a charge schedule. In the context of Joko et al., one cannot define particular times in a schedule during which the battery is available for charging. The nature of regenerative braking is such that it cannot be scheduled. Therefore, modification of Joko et al. to consider a charge schedule, as claimed, would change the principal of operation of Joko et al.

Accordingly, Applicant respectfully submits that claims 1 and 29, as amended, are patentable over Joko et al. and Adams, either alone or in combination, because Joko et al. and Adams do not teach or suggest each and every feature recited in any of claims 1 and 29, and because one skilled in the art would have no motivation to combine Joko et al. with Adams. Claims 2 to 5, 12 to 15, 30 to 33 and 36 to 39 depend from claims 1 and 29 and by definition contain all of the limitations of the independent claim upon which they depend. Accordingly, Applicant respectfully submits that claims 2 to 5, 12 to 15, 30 to 33 and 36 to 39 are patentable over Joko et al. for the reasons given above for claims 1 and 29, as well as because of the additional limitations contained therein.

Rejections Under 35 U.S.C. §103(a)

The Examiner rejected claims 16 to 23 and 40 to 44 under 35 U.S.C. §103(a) as being unpatentable over Joko et al. (U.S. Patent No. 5,939,861) in view of Adams (U.S. Patent No. 4,435,675) in view of Pavlovic et al. (U.S. Patent No. 6,965,216). The Examiner's rejection has been carefully considered but is traversed for the reasons that follow.

Applicants respectfully submit that the references cited by the Examiner do not disclose, teach or suggest receiving a plurality of parameters including a charge schedule "wherein said charge schedule defines times and time intervals during which the battery is available for charging" as recited in claim 16. Additionally, the references cited by the Examiner do not disclose, teach or suggest a component for receiving charge parameters including a charge schedule "wherein said charge schedule defines times and time intervals during which the battery

is available for charging" or "a component for applying a charge return model based on said charge parameters" or "wherein the charge return model is constrained by the charge schedule" as recited in claim 20. Additionally, the references cited by the Examiner do not disclose, teach or suggest computer executable instructions for receiving application environment parameters through a user input interface, including a charge schedule "wherein said charge schedule defines times and time intervals during which the battery is available for charging" as recited in claim 40.

As explained above with regard to claims 1 and 29, Applicants respectfully submit that Joko et al. and Adams, taken alone or in combination fail to teach or suggest "an energy transfer profile" as claims or consideration of a charge schedule wherein the charge schedule defines times and time intervals during which the battery is available for charging. Moreover, as explained, Applicants respectfully submit that one skilled in the art would have no motivation to combine Joko et al. with Adams.

Pavlovic et al. is directed to an apparatus and method for recharging a rechargeable lead acid battery. The apparatus supplies an overcharge current to the battery and before completion of recharging of the battery to ameliorate stratification of the battery. Applicants respectfully submit that Pavlovic et al. fail to remedy the defects of Joko et al. and Adams.

Accordingly, Applicants respectfully submit that claims 16, 20, and 40 are patentable over Joko et al., Adams, and Pavlovic et al., alone and in combination. Claims 17 to 19, 21 to 23 and 41 to 44 depend from claims 16, 20, and 40 and by definition contain all of the limitations of claims 16, 20, 40. Applicants respectfully submit that claims 17 to 19, 21 to 23 and 41 to 44 are patentable over Joko et al., Adams, and Pavlovic et al for the reasons given above for claims 16, 20, and 40 as well a because of the additional limitations contained therein.

Therefore, Applicants respectfully request that the rejection of claims 16 to 23 and 40 to 44 under 35 U.S.C. §103(a) be withdrawn.

Additional Rejections of Dependent Claims Under 35 U.S.C. § 103(a)

The Examiner rejected claims 6 to 9 and 34 under 35 U.S.C. § 103(a) as being unpatentable over Joko et al. (U.S. Patent No. 5,939,861) in view of Adams (U.S. patent No. 4,435,675) in view of Notten et al. (U.S. Patent No. 6,016,047). The Examiner rejected claim 10 under 35 U.S.C. 103(a) as being unpatentable over Joko et al. (U.S. Patent No. 5,939,861) in view of Adams (U.S. patent No. 4,435,675) in view of Notten et al. (U.S. Patent No. 6,016,047) and further in view of L. Martin (Journal of Heat Transfer, Nov. 1991, Vol. 113/899). The Examiner rejected claim 11 under 35 U.S.C. §103(a) as being unpatentable over Joko et al. (U.S. Patent No. 5,939,861) in view of Adams (U.S. patent No. 4,435,675) in view of Hughes et al. (U.S. Patent No. 6,326,765). The Examiner rejected claim 11 under 35 U.S.C. §103(a) as being unpatentable over Joko et al. (U.S. Patent No. 5,939,861) in view of Adams (U.S. patent No. 4,435,675) in view of Aker et al. (U.S. Patent No. 6,803,746).

The Examiner rejected claims 24 to 28 under 35 U.S.C. §103(a) as being unpatentable over Joko et al. (U.S. Patent No. 5,939,861) in view of Adams (U.S. patent No. 4,435,675) in view of Pavlovic et al. (U.S. Patent No. 6,965,216) and further in view of Hughes et al. (U.S. Patent No. 6,326,765). The Examiner also rejected claims 24 to 28 under 35 U.S.C. §103(a) as being unpatentable over Joko et al. (U.S. Patent No. 5,939,861) in view of Adams (U.S. patent No. 4,435,675) in view of Pavlovic (U.S. Patent No. 6,965,216) and further in view of Aker et al. (U.S. Patent No. 6,803,746).

The Examiner rejected claim 28 under 35 U.S.C. § 103(a) as being unpatentable over Joko et al. (U.S. Patent No. 5,939,861) in view of Adams (U.S. patent No. 4,435,675) in view of Hughes et al. in further view of Koenck (U.S. Patent No. 5,463,305) and as being unpatentable over Joko, Adams, and Aker et al. in further view of Koenck. The Examiner rejected claim 35 under 35 U.S.C. §103(a) as being unpatentable over Joko et al. (U.S. Patent No. 5,939,861) in view of Adams (U.S. patent No. 4,435,675) in view of Notten et al. and further in view of Hughes et al. The Examiner also rejected claim 35 under 35 U.S.C. §103(a) as being obvious over Joko et al. (U.S. Patent No. 5,939,861) in view of Adams (U.S. patent No. 4,435,675) in

view of Notten et al., and further in view of Aker et al. Finally, the Examiner rejected claim 45 under 35 U.S.C. § 103(a) as being unpatentable over Joko et al. (U.S. Patent No. 5,939,861) in view of Adams (U.S. patent No. 4,435,675) in view of Pavlovic et al. (U.S. Patent No. 6,965,216) in further view of Koenck.

The Examiner's rejections have been carefully considered but are traversed for the reasons that follow.

Claims 6 to 11, 24 to 28, 35 and 45 depend from claims 1, 20, 29 and 40 and by definition contain all of the limitations of claims 1, 20, 29 and 40. As explained above, Applicants respectfully submit that Joko et al. and Adams fail to teach to teach or suggest all of the limitations of any of claims 1, 20, 29 and 40, because Joko et al. and Adams, taken alone or in combination fail to teach consideration of a charge schedule wherein the charge schedule defines times and time intervals during which the battery is available for charging. As also explained above, Applicants respectfully submit that one skilled in the art would have no motivation to combine Joko et al. with Adams. Applicants respectfully submit that Pavlovic et al., Notten et al., L. Martin, Hughes, Aker et al., and Koenck, taken alone or in combination, fail to remedy the defects of Joko et al. and Adams.

Additionally, Applicants respectfully submit that one skilled in the art would have no motivation to combine Joko et al. with Hughes et al. Hughes et al. is directed to an electric scooter with an on-board charging system. The Examiner states that it would have been obvious to a person having ordinary skill in the art at the time of this invention to use Hughes et al.'s charging method, which according to the Examiner includes using an IVI profile with Joko et al.'s device to provide a full charge to the battery in less time then typical charging methods. Applicant respectfully disagrees.

As explained in Fig. 3 and in the specification in col. 2, line 1 to col. 3, line 17, Hughes et al.'s charging method referred to by the Examiner is used with a steady power source, namely a fuel cell for charging a battery back. Applicant submits that the charging method of Hughes et al. cannot be combined with the hybrid vehicle system of Joko et al, because regenerative

braking, which is the charge mechanism of Joko et al. is unscheduled and highly variable in duration. Thus, there is a lack of suggestion to combine the references.

Additionally, Applicants respectfully submit that one skilled in the art would have no motivation to combine the battery control system of Joko et al. with the high capacity charger taught by Aker et al. Applicants respectfully submit that one skilled in the art would not be motivated to combine the regenerative braking system of Joko et al., which is unscheduled and highly variable in duration, with the high capacity charger taught by Aker et al. Thus, there is a lack of suggestion to combine the references.

Finally, Applicants respectfully submit that the need to rely on combinations of four references as a basis for obviousness amounts to a hindsight analysis which in itself supports a finding that the invention is not obvious.

Accordingly, Applicants respectfully submit that claims 1, 20, 29 and 40 are patentable over the references cited by the Examiner. Additionally, Applicants respectfully submit that claims 6 to 11, 24 to 28, 35 and 45 are patentable over the references cited by the Examiner for the reasons given above for claims 1, 20, 29 and 40 as well as because of the additional limitations contained therein. Accordingly, Applicants respectfully request that the rejections of claims 6 to 11, 24 to 28, 35 and 45 be withdrawn.

CONCLUSION

In view of the above amendments remarks, Applicants respectfully submit that this application is in condition for allowance. Accordingly, reconsideration and a timely indication of allowance are respectfully requested.

If the Examiner believes a telephone conference would aid in the prosecution of this application, then the Examiner is invited to contact the undersigned at the below-listed telephone number.

A fee of $120 is believed due with the communication for a one month extension of time. The Commissioner is hereby authorized to charge this fee and any other fees due with this Response to Deposit Account No. 19-2090.

Respectfully submitted,
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APPENDIX A
INTERVIEW SUMMARY

A telephonic interview was conducted on December 6, 2006 with Examiner Samuel Berhanu and Applicants' representative Marc Karish. Prior to the telephonic interview, Applicants provided the Examiner with a proposed Amendment and Response to Office Action for review. Applicant provided reasoning and arguments why Joko et al. (U.S. Patent No. 5,969,861) and Adams (U.S. Patent No. 4,435,675) do not render claims 1-5, 12-15, 29-33 and 36-39 of the present application unpatentable under 35 U.S.C. §103(a). No agreement was reached.